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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/676,202 | 10/01/2003 | David M. Mills | 132147-2 | 7118 |

6147 7590 02/26/2007
GENERAL ELECTRIC COMPANY
GLOBAL RESEARCH
PATENT DOCKET RM. BLDG. K1-4A59
NISKAYUNA, NY 12309

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| EXAMINER |
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JAWORSKI, FRANCIS J

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| ART UNIT | PAPER NUMBER |
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3768

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
|--|------------|---------------|
| 3 MONTHS | 02/26/2007 | PAPER |

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/676,202

Applicant(s)

MILLS ET AL

Examiner

Jaworski Francis J.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 November 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 and 39-46 is/are pending in the application.
- 4a) Of the above claim(s) 5,10,19-21 and 43 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4,6 - 9, 11 - 18, 39 - 42 and 44 - 46 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claims 1 – 21, 39 – 46 remain in this case.

Claims 1 – 4, 6 – 9, 11 – 18, 39 – 42 and 44 – 46 are present for examination.

Claims 5, 10, 19-21 and 43 stand withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention and species, there being no allowable generic or linking claim. Election was made **with** traverse in the reply filed on 11/28/2006.

Claim Rejections - 35 USC § 102/103

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of

the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 6 – 8, 16 as amended and claim 42 , 45 are rejected under 35 U.S.C. 102(e) as anticipated by and claims 1,6-8 and 16 under 103(a) as obvious over Friemel et al (US 6537220).

Friemel on the one hand would teach at least closely associating a curved elevationally focusing mechanical cylindrical lens to a cMUT 1.5 or 1.75 D array per col. 2 bottom and col. 7. Alternatively there is suggestion to curve the array alternative to lens use per col. 3 top, wherein it would have been inherently obvious to curve the attendant backing substrate shown in the face figure. Freimel et al otherwise discuss hardwired groupings in association with alternating or zigzag energization patterns of array element energization.

Claims 1, 16, 18 and 42, 45 as amended are rejected under 35 U.S.C. 103(a) as being unpatentable over Barnes et al (US6676602, of record), alone or further in view of a) Ladabaum et al US2004/0000847 or Angelsen et al US2005/0043627 or Finsterwald et al (US5423220) or b) Angelsen et al as aforementioned, or Mault US2002/0103435 shows a curved belt; Barnes et al col. 1 sub-portion or Ustuner et al

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US6746402, all applicable against claims 1, 16 and 18 or c) Friemel et al (US6537220) additionally applicable against claims 42, 45

Barnes et al is directed to an ultrasound probe which is constructed of a cMUT array which may be formed in a rectangular row-column or an annular macro shape. The probe may be operated in a 1.25, 1.5, 1.75 mode, all of which pertain to the manner and degree of elevational focusing of the two-dimensional array or subarray of activated elements. The probe in and of itself may be either flat or curved, in which latter case (described in col. 3 lines 45 – 52, col. 12 lines 37 – 44, and col. 13 lines 52-59) if the probe is annular or spherical in overall shape the natural azimuthal delay may be offset by a counter-acting delay relative to the flat array and/or flat annular case, for obtaining an in-plane sector scan component of the 3-D volume acquisition. A lens may specifically be used as a transition member per col. 12 – 13 discussion.

Whereas the applicants would contend that this degree of disclosure would not serve to anticipate base claim 1 which requires a further 'coupled curved member' since Barnes et al contains no discussion of curvatures other than the array elements themselves and a curved pattern to the accompanying switches not equatable to a "curved member", and a lens may function without curvature dependent upon acoustic refractive indices, it is the Examiner's position that since the cMUT array is inextricably bound to and supported by the silicon substrate per the col. 9 – 10 discussion, it would have been inherently obvious to curve the backing as well as the array itself because otherwise the elements would be unsupported.

a) In the alternative, both of the pre-grant publications evidence that other artisans had contemplated manipulation of the curved member support and/or would use the silicon substrate as such a member: Ladabaum et al considered en bloc recommends simple thinning to accomplish curvature; Angelsen et al paras [0009 and 0022] suggests hinging the substrate from either or both sides to effect bend points. Finsterwald et al, a precedent patent discussed in Ladabaum et al, separately evidences that elevational curvature applied to a prior art ultrasound array would be supported by a concomitantly curved matching layer set 24, 26 as per col. 5 lines 35-53 and col. 8 lines 3-56.

[Finsterwald et al is the parent to the divisional US5637800 cited in the assignee's related US2005/0146247 Pre-grant Pub of 10/749,645 both the latter of which are of no further interest here.]

b) In the alternative still, since Barnes et al evidences that an 'elevationally focussed' cMUT array may simply be a flat 1.25/1.5/1.75 D array as the art defines these, without any accompanying physical curvature, the claims language merely recites that there is a curved member 'coupled to' the array within the overall context of a probe. A fair reading therefore is to invoke any such curved members couplable to a cMUT array, whereupon Angelsen et al shows a catheter which may flex and curve and compositely define an 'ultrasound probe'; Mault shows how the overall probe incorporates as a curved belt; the Barnes et al sub-portion is tantamount to describing a clinically useful probe cable portion as one that has few enough leads to be flexible for approach to the patient; Ustuner simply evidences that a micromachined transducer of

elevationally focused type (col. 2 lines 50-67) may come in a probe that is curved to fit the grip as shown in the patent face figure.

[Alternately stated the lack of association of curved member with any functionality for the array subjects the base claim to very broad alternative interpretations.]

c) Since Friemel et al establishes per its col. 2 bottom that a mechanical lens in association with such cMUT array functions as called for in Barnes et al, it would have been obvious in view of the latter to use a curved lens member such as 502 of Friemel et al for the mechanical lens suggested in Barnes et al.

Barnes et al otherwise in association with the construct of Fig. 6 notes that the microswitches may be fabricated within the substrate layer by CMOS techniques.

Claim Rejections - 35 USC § 103

Claims 2 – 4, 9 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Friemel et al alone, or Barnes et al in view of Friemel as argument c) as applied to claim 1 above, and further in view of Ishrak et al (US5677491) which evidences via element 502 of Figs. 5A-5B that a lens as in the former would be held on to the array by adhesive so it doesn't fall off. Such an epoxy layer would be a chemical barrier to diffusion in relation to the direct contact state such as by clamping the lens perimeter.

Claims 6 – 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barnes et al in view of Friemel et al insofar as the latter would teach hardwiring at least

some elements together for array energization purposes since in the former for example some macro-element pitch sizings are fixed.

Claims 11 – 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Friemel et al or Barnes et al in view of Friemel et al as applied to claim 2 above, and further in view of Hanafy (US6258034, of record) as applied for its lens detail teaching per page 3 para first of the prior Office action on the merits.

Claims 13 – 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Friemel et al/Barnes et al v Friemel et al, in either case v Ishrak et al as applied to claim 9 above, and further in view of Eaton et al (US5876345) as the latter was applied for its silicate/adhesion teachings per arguments page 4 of the prior 1/2006 Office action.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Friemel et al/Barnes et al v Friemel et al, in either case v Ishrak et al as applied to claim 9 above, and further in view of Snow (US6749554, of record) as the latter was applied on page 4 of the said prior action.

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Friemel et al or Barnes et al in view of Friemel et al as applied to claim 1 above, and further in view of Robinson (US6659954) since the latter taught col. 2 lines 1 – 10 to use pMUT arrays as an equivalent for ultrasound array fabrication.

Claim 18 is also rejected under 35 U.S.C. 103(a) as being unpatentable over Friemel et al as applied to claim 1 above, and further in view of Barnes et al insofar as whereas the former indicates generally that the cMUT array may be patterned with its

switches onto silicon, the latter extends this per col. 4 lines 54-67 and col. 8 line 66 – col. 9 line 37 to CMOS fabrication within the silicon wafer.

Claims 39 – 40, 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barnes et al v Friemel as discussed in relation to the claim 6 above, further in view of Chiao et al (US5882309) or Mason et al (US5931785) insofar as the latter respectively enhance the former interconnection teachings re 1.5D configuration by noting respectively col. 3 lines 15 – 38 and col. 7 lines 41 – 59 that transducers are hardwired or permanently connected in elevational pairs because the delay operation is symmetric in that case. Otherwise Barnes et al teaches the CMOS switch embedding within the silicon substrate, Friemel et al otherwise teaches that a mechanical lens such as in Barnes et al may be of curved type and in proximity to the MUT cells.

Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Barnes et al in view of Friemel et al, further in view of Chiao et al or Mason et al as applied to claim 39 above, and further in view of Robinson, for reasons paralleling the argument against claim 17.

Response to Arguments

Patentability for the base claim 1 is yet opposed both because a cMUT elevationally focused array may be a flat array in which case any ancillary structure associated with a probe that is a 'curved member' completes the reading of the prior art for purposes of generic claims; Barnes et al of itself is construed as strongly implying that the array therein when curved is constituted by curving of the support member, and

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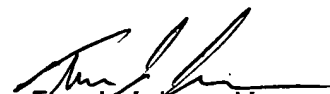
secondary teachings show that others had contemplating associating elevational curvature of a support member with array element macro curvature along with the evolution of MUT devices into ultrasound imaging use. Since both Friemel et al and Barnes et al suggest mechanical lens use with the former suggesting a curved lens the claimed features are then met by supplemental teachings in the prior art.

This action is NOT made final however the case should be prepared for final action.

Any inquiry concerning this communication should be directed to Jaworski Francis J. at telephone number 571-272-4738.

FJJ:fjj

02152007


Francis J. Jaworski
Primary Examiner